TECHNICAL REPORT

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Overview:

During the previous quarter the AX6600 was exercised on several long runs. This has allowed us to estimate the reliability of the overall design, and some areas have been identified where design improvements are possible. We also made progress in modeling, to determine whether the current reactor design is approximately optimized.

AX6600 Reactor and Facilities:

The reactor was run extensively, at high power, during this reporting period.

One run was an attempt to produce a large, high quality sample. To optimize quality, a relatively "lean" lower-growth process was run. A sample weighing 94.4 grams was produced, over a 258 hour run. The growth rate was 365 mg/hour, yielding a sample of 6" diameter, 1 mm thick.

We have performed some experiments over several runs to vary adhesion of the diamond film onto the molybdenum substrate. Improved control of the adhesion properties of the film would allow a higher yield of usable pieces.

Some of the diamond produced during these runs has a distinct greenish tinge. We suspect that this is due to copper impurity in the diamond; the source of the copper might be an inadequately cooled region of the stage. A redesign of this portion of the stage is under consideration.

Modeling Studies:

During the previous quarter the GEM code was used to explore systematically the effects of changes in geometry, pressure and power.

The objective of this search was to optimize the atomic hydrogen flux to the substrate -- both in absolute magnitude, and uniformity.

Geometry and Size:

Radius of Cylinder:
The simulation indicates that the radius of the cylinder could be reduced significantly without affecting flux or uniformity. This would have some impact on the reactor cost.

Height of Sample:
Seven runs with various combinations of stage height and substrate thickness were varied. The results indicate that this parameter is fairly well optimized by the current design.

Height of Cap:
The vertical height of the cap was varied over six runs. The results indicate that very slight improvements (< 5%) might be obtained by reducing this dimension.

Pressure and Power:
Neutral H_2 Pressure scan, at 50 and 70 kW. At 50 kW, it was observed that the flux to the substrated increased faster than linearly with pressure, but that above 150 torr axial peaking of the flux became significant. A similar result was obtained at 70 kW, but here the threshold at which unacceptable peaking was observed had been raised to 200 T.

Modeling Conclusions:
At this point, we feel that the GEM code runs confirm that the reactor design is not far from optimum. These results will be analyzed further.